

## MEASUREMENTS OF SOLAR AND SKY RADIATION.

By HERBERT H. KIMBALL.

[Author's abstract.]

This paper describes different methods of measuring the intensity of solar radiation and types of apparatus employed, and also recording apparatus for obtaining continuous records of the total solar and sky radiation received on a horizontal surface.

Measurements made at different stations of the Weather Bureau are summarized; and those for Washington are discussed briefly. The following are among the more important points developed:

The absolute monthly maxima of solar radiation intensities, measured about noon on a surface normal to the direction of incidence of the solar rays, vary but little throughout the year at Washington, show minimum values in the summer at Santa Fe, N. Mex., and at Madison, Wis., show a maximum in the early spring and a minimum in summer.

With a clear sky the daily totals of solar and sky radiation received on a horizontal surface at Washington exceed 750 gram-calories per square centimeter early in June and are but little in excess of 300 calories in the latter part of December. The average daily amounts at these two seasons, including all sorts of weather, are 70 per cent and 55 per cent, respectively, of what is received on clear days.

From March 10 to September 10 the heat received from the sun and sky on clear days on each square meter of horizontal surface is equivalent to the energy required to run twenty-five 40-watt electric lamps for 7 hours.

## MONTHLY STORM FREQUENCY IN THE UNITED STATES.

By C. J. KULLMER.

A brief summary of the author's previous work on the storm frequency of the United States is given. The present investigation covers the 30-year period 1883-1912, and furnishes a 30-year map of the distribution of storms for each month and also three 10-year maps for each month covering the same period. A comparison of the three 10-year periods shows the extent of variability of storm frequency and discloses a remarkable constancy of the general storm area, increased storminess intensifying areas of normal high frequency. From a discussion of the figures for western Canada and for the Southwestern States, the conclusion is reached that an actual change has taken place in those regions. A general progressive southerly shift of the storm area is revealed by a detailed study of the abrupt northern boundary of the storm area.

## PRESENT CONDITION OF METEOROLOGY AND SEISMOLOGY IN HONDURAS.

By LUIS LANDA.

[Author's abstract.]

Under the heading of present conditions the author describes the geographic position of the Republic of Honduras and the atmospheric phenomena of that country, such as rainfall, frost, fog, hail, mist, rainbow, lightning, winds, meteorites, giving important data concerning each one.

In the second part of this paper, entitled "Seismological Phenomena," the author sets forth the most important phenomena in this field which have occurred in Central America, such as the eruption of Cosiguina, which took place January 20, 1835.

The author then describes the only meteorological station in Honduras. This station is situated in Camayagüela, 14° 8' N. and 87° 15' W. It is located at an altitude of 914 meters above sea level.

With reference to the needed stations the author is of the opinion that four meteorological and seismological stations distributed as widely as possible would be sufficient.

The last part of the paper contains a table of meteorological data collected by the Observatory of Camayagüela during the month of July, 1915.

## THE CLIMATE OF CUBA.

By MARIANO GUTIERREZ-LANZA, S. J.

[Author's abstract.]

After some general considerations with reference to the benefits of atmospheric circulation and the laws governing it, the author observes that one of the best points from which to study meteorology is the city

of Habana, situated on the border of the tropical zone between the equatorial and polar regions, where the atmospheric circulation takes its rise and receives its greater impulse. At this point is situated the observatory of the College of Belén, which is about to conclude 58 years of very complete observations which constitute the basis of the present study.

The study of the material with which the paper properly deals is preceded by three important chapters. In the first the geographic position of Cuba is given, the configuration of the ground, with its mountain and river systems, is described and the general ocean and atmospheric currents which affect the climate of the island are mentioned. In the second a complete relation is given of the series of observations made in Cuba; that is, all the existing materials which serve as a basis for the study of the climate of Cuba. In the third preliminary chapter the circumstances which give value to the collection of the observatory of Belén are set forth, since those data have furnished the materials for the construction of the tables and curves contained in this paper. The geographic position of the observatory, its situation within the city of Habana, the conditions under which the instruments are exposed and the quality of the same, the hours of daily observations and the phenomena noted, together with an outline of the history of the changes which have occurred in the form of a publication of the observations from the foundation of the observatory up to the present time, all are included.

The body of the study treats principally of the climate of Habana. Here the following climatic factors are considered separately: Atmospheric pressure, temperature in the shade, relative humidity, vapor tension, rainfall, and the laws of the prevailing winds. The study of these factors is accompanied by four tables for each one, three of which show the daily variation in each phenomenon and the fourth the most salient data of the same. Furthermore, curves showing the daily variation in each month of the year as well as the annual variation have been constructed. The study contains likewise a plate showing the curve of the annual variation in atmospheric pressure in other islands of the West Indies. This plate shows clearly the existence of a second abnormal barometric maximum for July.

Rainfall in Habana and its distribution form an interesting part of the study. In tabular form a complete history of rainfall in the Cuban capital from 1859 to 1914 is given. In another table general data of importance with reference to precipitation are given. To these are added two others, one of which is graphic, of the annual rainfall of the whole period. Finally the physical laws of winds are studied. The study is accompanied by a table which indicates the relative frequency of the various directions of the prevailing winds in Habana. The daily average velocity of the wind for each month is given.

In a supplement to his study the author treats briefly the climatic factors, atmospheric pressure, temperature, rainfall, and winds at a number of stations distributed throughout the island. Tables showing monthly and annual averages of the first three factors mentioned above are given.

## BOLIVIAN METEOROLOGY.

By CONSTANT LURQUIN.

[Author's abstract.]

The present report on meteorology in Bolivia is a memoir that relates to the last subject indicated in the subsection of meteorology of the Second Pan-American Scientific Congress. This work has for its object to make known, as far as possible, the present organization of meteorology in Bolivia. Also to indicate the pressing needs that demand a rational study of meteorological phenomena.

The following subjects are considered in this report:

I. Meteorological stations: (1) Geographic coordinates and height above sea level, (2) publications of the results of the observations, (3) entry of observations, (4) meteorological phenomena observed.

II. Bolivian meteorology: (1) Official project for a national meteorological service, (2) telegraphic information.

III. Conclusion—Supplements: (1) A list of the studies published by the staff of the meteorological section of the Sucre Medical Institute, (2) meteorological documentary.

The author presents to the congress the following proposition relative to the Pan-American topic of Section II.

"Having in view the benefits and utilities that a detailed study of the atmospheric phenomena would bring to the nations of the South American Continent and to science in all its branches, and the convenience of verifying this study according to a scientific program for the progress of American meteorological science, the Second Pan-American Scientific Congress decide unanimously that each American Government that has not at present established a meteorological service should do so, provided with all the indispensable instruments for direct reading, and also of double registry apparatus of each one of the meteorological elements."